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Notes on some myxomycetes from Crimea (Ukraine)

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Abstract—Twenty-seven collections of myxomycetes represented by field collections obtained in two nature reserves from southern Crimea were studied. Among 25 species identified, *Diderma effusum, D. montanum, Didymium difforme*, and *Perichaena pedata* represent new records for Crimea, and *Physarum hongkongense* is recorded from the Ukraine for the first time. LM and SEM microphotographs are provided for rare or uncommon species recorded in the study area to illustrate their micromorphology.

Key words—*Amoebozoa,* chorology, myxobiota, slime moulds, taxonomy

Introduction

The Crimean peninsula, which occupies a part of the northern Black Sea coast, covers 26,200 km^2 (Leontyev et al. 2011). The climate of Crimea varies over a broad range, depending on the proximity to the sea and topography. The northern peninsula is covered by steppes, while in the south habitats with a Mediterranean climate can be found, protected from the northerly winds by the influence of the Black Sea and the Crimean Mountains.

The myxomycetes described below were collected in two nature reserves of southern Crimea: the Crimean Nature Reserve and Yalta Mountain-Forest

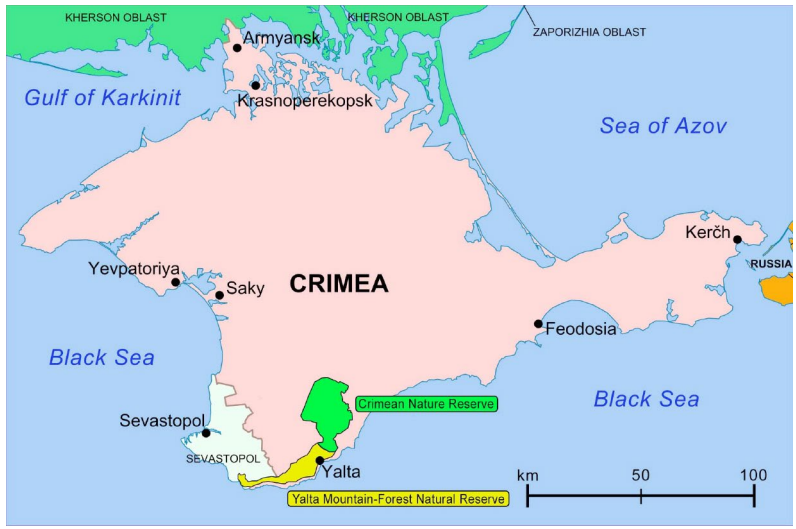

Fig. 1. Location of the two nature reserves studied in southern Crimea: the Crimean Nature Reserve and the Yalta Mountain-Forest Reserve.

Reserve. Both are located on the southern coast of the peninsula (Fig. 1). The territory of both reserves is covered predominately by mountain forests of beech (*Fagus*), oak (*Quercus*), hornbeam (*Carpinus*), and pine (*Pinus*).

The first data relating to Crimean myxomycetes were published by the French mycologist J.H. Léveillé (1842), who found four species of these organisms on the territory of peninsula. For more than one century after this work, only fragmentary data were published about Crimean myxomycetes, until Y.K. Novozhilov, using the moist chamber culture method, recorded 26 species of these organisms in the Nikita Botanic Garden and Cape Martyan Nature Reserve (Novozhilov 1988). At the same time, studies of xerophytic myxomycetes were carried out mostly in mountain forest areas (Dudka et al. 1999, Leontyev 2005), and Dudka (2000) provided the first data on the diversity of nivicolous myxomycetes of Crimea.

A comprehensive study of myxomycete diversity and ecology in the Crimean Nature Reserve was carried out by K.O. Romanenko, who collected there 105 myxomycetes, mostly from *Physarum* (10 species), *Arcyria* (9), *Trichia* (9), *Cribraria* (9), *Licea* (7), *Stemonitis* (6), *Perichaena* (6), and *Echinostelium* (6) (Romanenko 2002, 2006). In 2008, the 6th International Congress for Systematics and Ecology of Myxomycetes was held in Crimea, and the

illustrated list of myxomycetes found during congress forays was published as a separate monograph (Leontyev et al. 2009). Some of these collections were later used to study the morphology of 14 rare myxomycetes that appeared to be new for Crimea and the Ukraine (Leontyev et al. 2011). Two new species have recently been described based in part on the material collected in Crimea (Leontyev et al. 2015). Currently, 121 species of myxomycetes are known from the peninsula.

In the studies mentioned above, a number of myxomycete collections were not correctly identified, and we present our morphological and ultrastructural conclusions below. While we focus on rare and new findings, we also provide information about well-known species for which original collections were misidentified.

Material & methods

The examined material includes specimens obtained from field samples collected by K.O. Romanenko, I.O. Dudka, and V.V. Kuzub and originally attributed to 24 myxomycete species. Specimens are kept in the herbarium of the Life Sciences Department (Botany), University of Alcalá, Madrid, Spain (AH).

Spore measurements (taken using oil immersion) include surface structures such as spines or warts. Light microscopy (LM) was carried out with the Nikon eclipse 80i microscope equipped with an automatic photographic system DS-5M. Scanning electron micrographs (SEM) were provided by a Zeiss DSM-950 microscope.

For ultramicroscopic studies, material was rehydrated in concentrated ammonium hydroxide (28–30%) for 30 min, dehydrated in aqueous ethanol (70%) for 30 min, fixed for 2 h in pure ethylene glycol dimethyl ether (1,2–dimethoxymethane), and finally immersed in pure acetone for at least 2 h. This was followed by critical point drying and sputtering with gold-palladium. This technique allows the use of very little material (i.e., part of a single sporocarp or sometimes no more than a few spores).

Taxonomy

Arcyria stipata (Schwein.) Lister, Monogr. Mycetozoa: 189 (1894) Fig. 2a–c

Sporocarps reddish brown to olivaceous brown, with long stalks. Peridium evanescent, its remnants forming a calyculus. Capillitium brown-olivaceous at maturity, attached by few threads in the centre of the calyculus. The capillitium is formed by spiral filaments, clearly visible by SEM, accompanied by small warts (not visible in LM). Spores, 6–8 μm diam., globose to subglobose, hyaline-yellow in transmitted light, ornamented with two types of warts: [1] comparatively large and forming small clusters and [2] rather small and evenly distributed on the spore surface [both 1&2 visible under SEM, but 2 not visible in LM].

Specimens examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Chatyr-Dag, wood of *Fagus sylvatica*, 9-X-1999, leg. I.O. Dudka fc-501 (AH 46381); Izobilniy forestry, cordon Black River, 800 m, beech forest, wood of *Fagus sylvatica*, 21-IX-2000, leg. K.O. Romanenko fc-267 (AH 45899).

Diderma effusum (Schwein.) Morgan,
J. Cincinnati Soc. Nat. Hist. 16: 155 (1894) Figs 2d, 3a

This sample consists of two pieces of wood with several sessile sporocarps and short plasmodiocarps. The peridium is composed of two layers: the outer layer calcareous and the inner layer membranous. Columella not observed. The capillitium is formed by smooth hyaline filaments. Spores 8–9 µm diam., globose to subglobose, pale brown in transmitted light (LM), verrucose. As seen by SEM, the warts sometimes fuse together to form short crests.

Specimen examined: **UKRAINE**, **Crimea**, **Yalta Mountain-Forest Nature Reserve**, Waterfall Uchan-Su, wood of deciduous tree, 17-V-2000, leg. V.V. Kuzub fc-503 [as *Diderma* cf. *deplanatum*] (AH 45900).

Remarks—*Diderma deplanatum* Fr. shows a capillitium formed by darker, nodulose filaments and spores with spinulose ornamentation (Martin & Alexopoulos 1969). *Diderma effusum* is a cosmopolitan species, distributed in both the northern and southern hemispheres (http://discoverlife.org). This represents a first report for the Crimea.

Diderma montanum (Meyl.) Meyl., Diagn. Mycoth. Univ. Cent. 53: 454 (1921)
Fig. 3b

Sporocarps stalked, with double peridium. Stalk white or cream colour, short. Columella whitish, occupying the large portion of the inner sporocarp. Capillitium formed by slightly sinuous filaments, branched, with nodules, faintly violet. Spores 10–10.5 µm diam., globose to subglobose, violet, ornamented with prominent visible warts.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Central forestry, the mountain ridge Sinap-Dag, 1000 m, beech forest, leaf litter of *Fagus sylvatica*, 15-VII-2001, leg. K.O. Romanenko fc-293 [as *Diderma radiatum*] (AH 45901).

Remarks— This sample originally was identified as *Diderma radiatum* (L.) Morgan, which is distinguished by its occurrence on woody substrates and the

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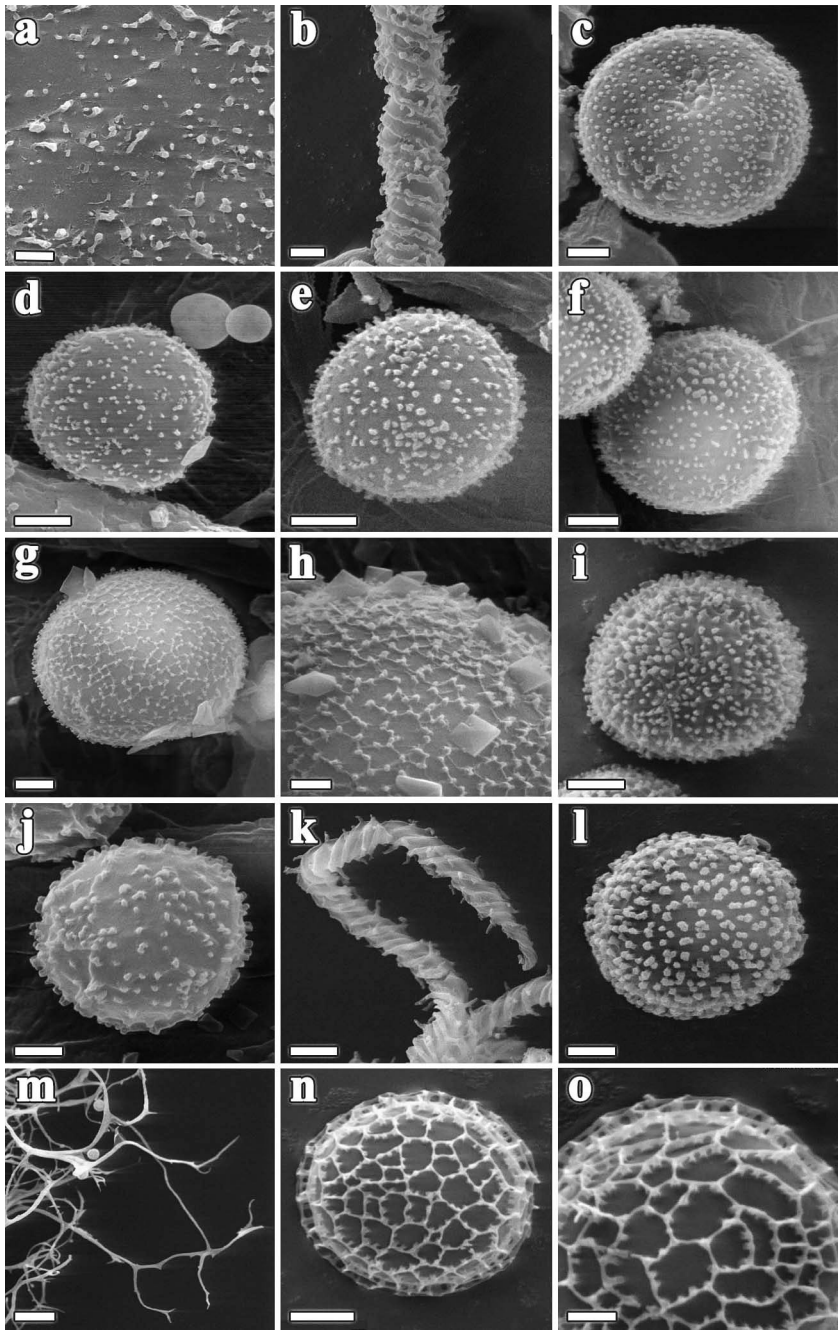
Fig. 2. ***Arcyria stipata***: a. Inner surface of calyculus; b. Detail of capillitium; c. Spore. ***Diderma effusum***: d. Spore. ***Diderma testaceum***: e. Spore. ***Didymium anellus***: f. Spore. ***Didymium difforme***: g. Spore ornamentation; h. Spore. ***Didymium minus***: i. Detail of spore ornamentation. ***Didymium trachysporum***: j. Spore. ***Metatrichia vesparium***: k. Detail of capillitium; l. Spore ornamentation. ***Symphytocarpus amaurochaetoides***: m. Free ends of capillitium; n. Spore; o. Detail of spore ornamentation. Scale bars: a, b, d–g, i, j, l, n = 2 µm; c, h, o = 1 µm; k = 5 µm; m = 20 µm.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brownish peridium, which dehisces to form stellate breaking plates. The sample is similar to the Poulain et al. (2011) representation of *Diderma montanum* var. *album* (Torrend) G. Lister, showing the whitish sporotheca and stalk.

A study of the SEM spore ornamentation was by Sánchez & Moreno (2014).

Diderma montanum is widely distributed in the northern hemisphere (http://discoverlife.org); this represents a first report from Crimea.

Diderma spumarioides (Fr.) Fr., Syst. Mycol. 3: 104 (1829)

Sporocarps large, hemispherical, sessile, whitish, grouped on a wide white hypothallus. Peridium fragile. Columella whitish, globose to pulvinate. Capillitium branched, formed by hyaline filaments, straight, ornamented with occasional nodules. Spores 10–11 µm diam., globose to subglobose, pale brown in transmitted light, verrucose.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Bakhchysarai forestry, cordon Ammonalniy, 700 m, oak–maple forest, leaf litter of *Acer campestre* and *Quercus robur*, 25-VII-2001, leg. K.O. Romanenko fc-288 (AH 45902).

Remarks—Buyck (1988) analyzed the differences between *D. spumarioides* and two similar species, *Diderma cinereum* Morgan and *D. globosum* Pers.: *D. cinereum* is distinguished by its very slender and flexuous capillitium that is not formed by hyaline straight filaments, while *D. globosum* has a distinctly double peridium with widely separated layers, while *D. spumarioides* has a peridium which appears to be single (sometimes clearly double) but with both layers always adhering very closely.

Diderma testaceum (Schrad.) Pers., Syn. Meth. Fung.: 167 (1801) Figs 2e, 3c

This specimen consists of nearly 100 sporocarps, seated on leaf litter. Sporocarps sessile. Peridium double, the outer layer crustaceous similar to an eggshell, pinkish to pink-violaceous. The inner layer membranous, yellowish-brown. Columella the same colour as the outer layer of the peridium. Capillitium formed by branched filaments, very thin (1 µm diam.) hyaline, with violaceous areas. Spores 8–9 µm diam., globose to subglobose, pale-brown, minutely warted. Warts under SEM show an irregular distribution, with 2–3 baculae sometimes fusing to form short crests.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Bahchesaray forestry, cordon Olen, 600 m, durmast forest, leaf litter of *Quercus petraea*, 4-X-2001, leg. K O. Romanenko fc-435 (AH 45903).

Didymium anellus Morgan, J. Cincinnati Soc. Nat. Hist. 16: 148 (1894) Fig. 2f

The specimen includes abundant sporocarps, formed on leaf litter. Sporophores: sporocarps globose, plasmodiocarps short umbilicate. Peridium

double-layered, the outer layer formed by calcium carbonate crystals and the inner membranous, tessellate, brown. Dehiscence stellate. Columella prominent, large, globose to flattened, with whitish crystals inside. Capillitium abundant, formed by branched hyaline tubes about 1 μm diam. Spores 8–10 μm diam., globose to subglobose, pale violet, verrucose, with groups of warts more prominent. Under the SEM spores appear ornamented primarily by small evenly distributed warts, with some larger warts gathered in small groups.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Central forestry, the plateau Babugan-Yayla, 900 m, beech forest, leaf litter of *Fagus sylvatica*, 27-VII-2001, leg. K.O. Romanenko fc-296 (AH 45903).

Didymium clavus (Alb. & Schwein.) Rabenh., Deutschl. Krypt.-Fl. 1: 280 (1844)

Sporocarps stalked. Sporotheca disc-shaped, seated on a short and wide stalk. Peridium whitish, formed by calcium carbonate crystals. Stalk black-brown to black, longitudinally striate. Capillitium sparse, formed by hyaline threads. Spores 5–6 μm diam., globose to subglobose, violet-brown, verrucose.

Specimens examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Central forestry, the hill Big Chuchel, 900 m, beech forest, leaf litter of *Fagus sylvatica*, 13-VII-2001, leg. K.O. Romanenko fc-292 (AH 45904); 13-VII-2001, leg. K.O. Romanenko fc-306 (AH 45905).

Didymium difforme (Pers.) Gray, Nat. Arr. Brit. Pl. 1: 571 (1821) Figs 2g,h, 3d

Sporophores: sporocarps sessile pulvinate, plasmodiocarps short. Peridium double, the outer wall crustose, the inner smooth. Capillitium composed of scanty, dichotomously branching threads. Spores minutely verrucose under LM.

Specimens examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Central forestry, the plateau Babugan-Yayla, 1000 m, alpine meadow, on the live stem of *Sideritis montana*, 27-VII-2001, leg. K.O. Romanenko mc-448 (AH 46048 – two boxes); 27-VII-2001, leg. K.O. Romanenko mc-442 [as *Didymium trachysporum*] (AH 46049).

Remarks—*Didymium difforme* is a cosmopolitan species (http://discoverlife.org); however, there are no previous records from Crimea.

Didymium minus (Lister) Morgan, J. Cincinnati Soc. Nat. Hist. 16: 145 (1894) Figs 2i, 3e

The specimen is represented by scattered sporophores in large colonies on leaf litter. Sporocarps sessile, globose with short plasmodiocarps, ≤1 mm diam. Peridium covered with white calcium carbonate crystals. Columella large, globose and sessile, rust-brown and dark brown. Capillitium formed by hyaline filaments ≤1 μm diam. Spores (7.5–)8–10 μm diam., globose to subglobose,

violet-brown, warted, with darker warts gathered in groups. The SEM shows an ornamentation of prominent and densely aggregated warts.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Central forestry, the mountain ridge Sinap-Dag, 1000 m, beech forest, leaf litter of *Fagus sylvatica*, 4-X-2001, leg. K.O. Romanenko fc-304 [as *Didymium melanospermum*] (AH 45908).

Didymium nigripes (Link) Fr., Syst. Mycol. 3: 119 (1829)

This sample has been identified as *Didymium nigripes* based on its stipitate sporocarps, rarely exceeding 1 mm in height with a stalk at least 2 times larger than the sporothecal diameter. Peridium covered by white calcium carbonate crystals. Stalk dark-brown to black. Columella subglobose, dark-brown. Spores, 8–9 µm diam., globose to subglobose, violet-brown, ornamented with warts, some of which are in clusters.

Specimen examined: **UKRAINE**, **Crimea**, **Yalta Mountain-Forest Reserve**, Gurzuf forestry, oak forest, leaf litter of *Quercus pubescens*, 5-X-1999, leg. I. O. Dudka fc-502 [as *Didymium minus*] (AH 45909).

Remarks—*Didymium bahiense* Gottsb. is a species closely related to *D. nigripes* but its white columella contrasts with the black or dark-brown columella of *D. nigripes.* In addition, *D. nigripes* has a thinner stalk and smaller spores.

Didymium squamulosum (Alb. & Schwein.) Fr., Symb. Gasteromyc.: 19 (1818)

Sporocarps scattered, stipitate, forming large colonies. Sporotheca subglobose to lenticular. Peridium single, covered with white calcium carbonate crystals. Stalk amber or honey-yellow, with orange tints. Columella globose, the same color as the stalk. Capillitium hyaline to pale gray. Spores 10–11 µm diam., globose to subglobose, dark purplish- brown, with prominent dense warts and often collapsing into polygonal shapes.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Bakhchysarai forestry, cordon Ammonalniy, 700 m, oak–maple forest, leaf litter of *Acer campestre* and *Quercus robur*, 25-VII-2001, leg. K.O. Romanenko fc-287 (AH 45910).

Remarks—*Didymium squamulosum* is a cosmopolitan species (Martin & Alexopoulos 1969).

Didymium trachysporum G. Lister, Essex Naturalist 20: 113 (1923) Fig. 2j

Sporocarps sessile, small, 0.1–0.2 mm diam, globose. Peridium double, with very firmly fused layers: the outer layer forming a white to pale-gray crust, the inner layer hyaline. Columella absent or rudimentary. Capillitium poorly developed, consisting of straight filaments, hyaline to slightly colored ≤1 µm diam. Spores 10–11 µm diam., globose to subglobose, violet, ornamented by

prominent warts, irregularly distributed with 2–3 sometimes fused into short crests. Under SEM the irregularly distributed warts are observed on spore surface.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Yalta forestry, the plato Nikitskaya Yayla, 1325 m, alpine meadow, on mosses and soil, 13-VI-2000, leg. K.O. Romanenko mc-5 (AH 45911).

Remarks—*Didymium trachysporum* was first recorded for the Crimea by K.O. Romanenko (2002); our record represents the second for the peninsula.

Licea kleistobolus G.W. Martin, Mycologia 34: 702 (1942) Fig. 3f

This species can be easily recognized by its sessile sporocarps with a grayish, weakly iridescent broad apical operculum. Spores 7–8 μm diam., globose to subglobose, yellowish-hyaline in transmitted light, ornamented with warts and groups of prominent warts.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Izobilniy forestry, cordon Taryer, 700 m, pine forest, bark of *Pinus pallasiana*, 26-IX-2000, leg. K.O. Romanenko mc-429 (AH 45912).

Remarks—A thorough SEM study of *Licea kleistobolus* material from Baja California (Mexico) was carried out by Moreno et al. (2001).

Licea minima Fr., Syst. Mycol. 3: 199 (1829) Fig. 3g,h

Sporocarps sessile. Peridium splitting into polygonal plates, with the edges of each plate covered by tooth-like warts. Spores 9–10 μm diam., globose to subglobose, rust-brown in mass and pale brown olivaceous in transmitted light, ornamented by prominent warts.

Specimens examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Bakhchysarai forestry, the mountain ridge Uskularskiy, 700 m, pine forest, dead wood of *Pinus sylvestris*, 2-VIII-2001, leg. K.O. Romanenko mc-463 (AH 45913); Yalta forestry, cordon Grushovaya Polyna, 700 m, pine forest, dead wood of *Pinus* sp., 6-X-2001, 700 m, leg. K.O. Romanenko mc-387 (AH 45914).

Licea operculata (Wingate) G.W. Martin, Mycologia 34: 702 (1942) Fig. 3i,j

Sporocarps stipitate, 0.5–0.8 mm high overall. Sporotheca 0.05–0.1 mm diam., dehiscing by means of a round lid (operculum). Peridium blackish brown. Stalk 2–4 times longer than sporothecal diameter. Spores 10–11 μm diam., globose to subglobose, hyaline-yellow, smooth and with a thickened wall portion.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Izobilniy forestry, cordon Asport, 450 m, bark of *Picea abies*, 2-X-2000, leg. K.O. Romanenko mc-202 (AH 45915).

Remarks—A complete study of *Licea operculata* including the SEM photographs was carried out by Wrigley de Basanta & Lado (2005).

Licea parasitica (Zukal) G.W. Martin, Mycologia 34: 702 (1942) Fig. 3k

Sporocarps globose to pulvinate. Peridium opening through an operculum that covers the apical half of the sporotheca. Spores 14–15 µm diam., globose to subglobose, dark-brown in mass, greenish in transmitted light, smooth, with pale area covering a quarter to a half of the spore surface.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Bakhchysarai forestry, cordon Zubrovaya Polyana, bark of *Taxus baccata*, 18-VII-2001, 500 m, leg. K.O. Romanenko, mc-331, AH 45916.

Licea variabilis Schrad., Nov. Gen. Pl.: 18 (1797) Fig 3l

Sporophores are sessile sporocarps or plasmodiocarps. Peridium dark-brown, dehiscence irregular. Spores 10–12 µm diam., globose to subglobose or oval, grey in mass, pale yellow in transmitted light, with spinulose ornamentation.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Central forestry, cordon Bukovskiy, 900 m, beech forest, wood of *Fagus sylvatica*, 10-VII-2001, leg. K.O. Romanenko mc-363 (AH 45917).

Metatrichia vesparium (Batsch) Nann.-Bremek. ex G.W. Martin & Alexop., Myxomycetes: 143 (1969) Figs 2k,l, 3m

Sporocarps clustered on common stalk. Peridium thick, dark-brown. Stalk reddish-brown. Capillitium reddish, formed by elaters with slightly marked spiral bands that are ornamented with 1–2 µm long spines. Spores 9–10 µm diam., globose to subglobose, pale yellow, minutely spinulose.

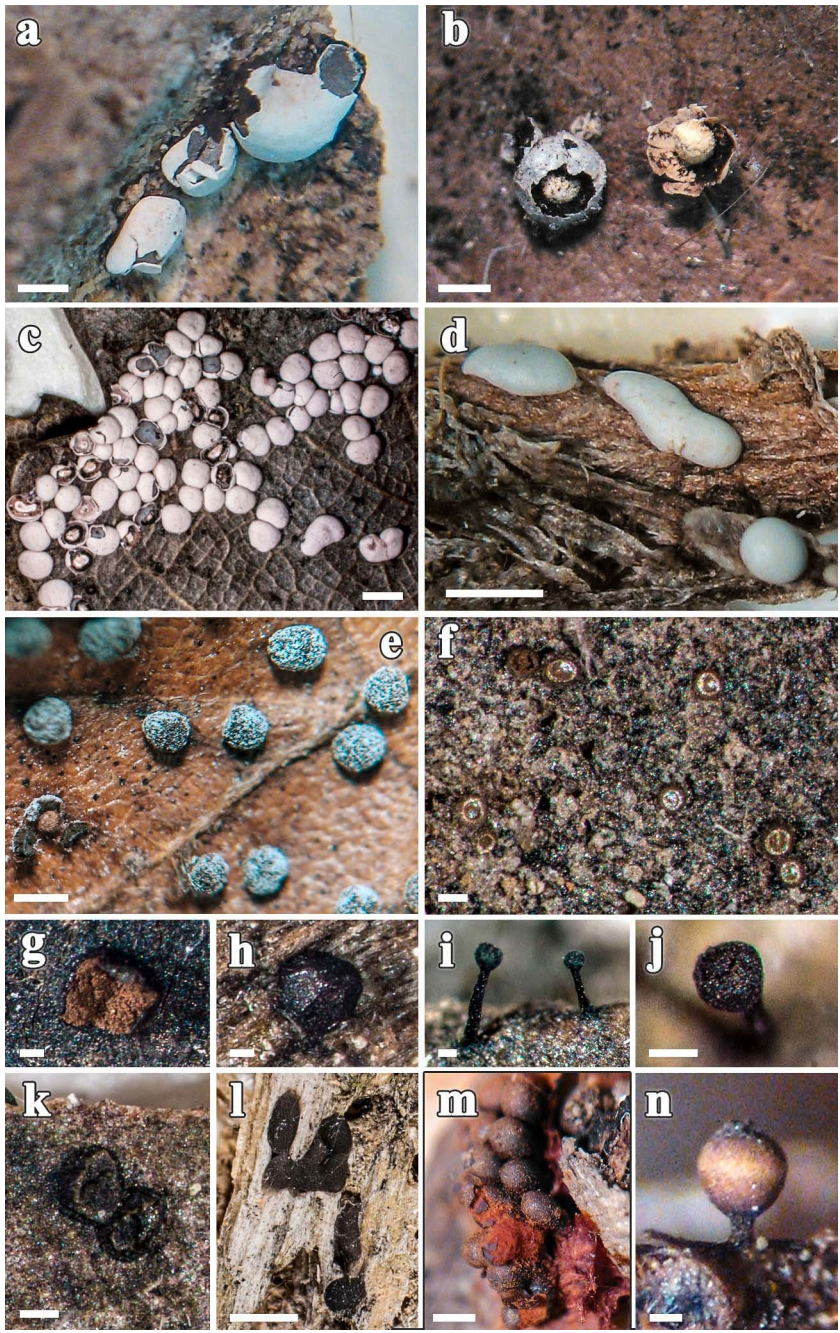
Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Central forestry, cordon Bukovskiy, 1000 m, beech forest, wood of *Fagus sylvatica*, 10-VII-2001, leg. K.O. Romanenko fc-141 [as *Metatrichia horrida*] (AH 45918).

Remarks—*Metatrichia horrida* Ing is a similar species with threads also spirally arranged within the sporotheca, but its elaters have more abundant and longer (3–5 µm) spines (Moreno et al. 1997).

Perichaena pedata (Lister & G. Lister) Lister ex E. Jahn, Ber. Deutsch. Bot. Ges. 36: 667 (1919) Fig. 3n

Sporocarps stalked, 0.1–0.3 mm high overall. Peridium dark brown. Stalk well developed, darkish, cylindrical, the same height as the sporothecal

Fig. 3. Sporophores. a. ***Diderma effusum***; b. ***Diderma montanum***; c. ***Diderma testaceum***; d. ***Didymium difforme***; e. ***Didymium minus***; f. ***Licea kleistobolus***; g, h. ***Licea minima***; i, j. ***Licea operculata***; k. ***Licea parasitica***; l. ***Licea variabilis***; m. ***Metatrichia vesparium***; n. ***Perichaena pedata***. Scale bars: a–d, l, m = 1 mm; e = 0.5 mm; f–k, n = 0.1 mm.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diameter. Capillitium yellow, formed by branched filaments ornamented with warts and short spines. Spores 9–10 µm diam., globose to subglobose, yellowish in transmitted light, warted.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Central forestry, cordon Uzen-Bash, 800 m, beech forest, on fallen leaves and nutlets of *Fagus sylvatica*, 23-IX-2000, leg. K.O. Romanenko mc-237 [as *Hemitrichia minor*] (AH 45919).

Remarks—Although widely distributed in the northern hemisphere (http://discoverlife.org), *Perichaena pedata* was not previously recorded from Crimea.

Physarum cinereum (Batsch) Pers., Neues Mag. Bot. 1: 89 (1794)

Sporocarps abundant, sessile. Peridium double, covered with white calcium carbonate granules. Capillitium composed of branching hyaline threads, with small, white, subglobose to fusiform nodes, sometimes fused in the sporocarp center, thus forming a variably sized pseudocolumella. Spores 8–9 µm diam., globose to subglobose, violet-brown, verrucose.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Central forestry, the mountain ridge Sinap-Dag, 900 m, beech forest, leaf litter of *Fagus sylvatica*, 15-VII-2001, leg. K.O. Romanenko fc-302 (AH 45921).

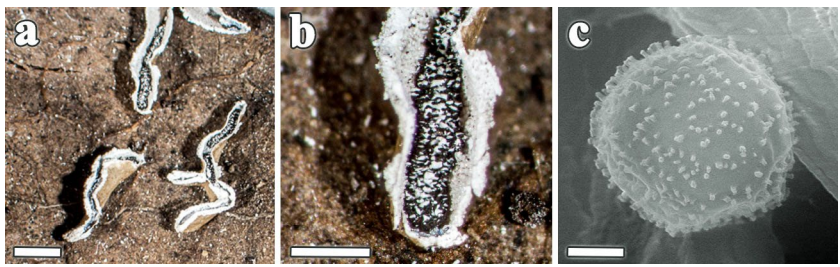

Fig. 4. ***Physarum hongkongense***.
a. Sessile sporocarps; b. Detail of capillitium; c. Spore ornamentation.
Scale bars: a,b = 1 µm; c = 2 µm.

Physarum hongkongense Chao H. Chung, Slime Moulds Hong Kong: 19 (1997)
Fig 4

Sporophores: sessile sporocarps or short plasmodiocarps, sinuous, strongly compressed laterally. Dehiscing along a pre-formed fissure at the top of the sporocarp. Peridium double, with outer layer limy, bright yellow or brown-yellowish and inner layer membranous, hyaline, iridescent. Capillitium reticulate, very abundant, formed by hyaline tubes with numerous, whitish, fusiform or subglobose nodes. Spores 8–9 µm diam., globose to subglobose, violet-brown, minutely warted.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Bakhchysarai forestry, cordon Ammonalniy, 700 m, hornbeam forest, leaf litter of *Carpinus betulus*, 19-VII-2001, leg. K.O. Romanenko fc-299 [as *Physarum bivalve*] (AH 45920).

Remarks—*Physarum bogoriense* Racib. is a related species that differs from *Ph. hongkongense* morphologically by the shape of the sporocarps, which are not flattened laterally, and the apical dehiscence in irregular recurved lobes. We have not observed remarkable microscopic differences between the two species (spore measures and shape and colour of the capillitium). *Physarum bivalve* Pers. is also similar to *Ph. hongkongense* but differs by its white or pale brown peridium.

Physarum hongkongense is generally rare and recorded in relatively few locations in Canada, Cyprus, France, Japan, New Zealand, Puerto Rico, Spain, Taiwan, Thailand, and USA (http://discoverlife.org). Our record is new for the Ukraine.

Reticularia jurana Meyl., Bull. Soc. Vaud. Sci. Nat. 44: 297 (1908)

Aethalium pulvinate, 2.5–25 mm diam. Cortex membranous, reddish-brown, covered by reticulate pattern. Pseudocapillitium formed by thin (1–2 μm diam.) branched filaments, smooth, reddish-brown, forming a closed network. Spores 6–8 μm diam., globose to subglobose, light brown; one half of the spore surface is reticulate, while the rest is smooth.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Izobilniy forestry, cordon Asport, 700 m, durmast forests, wood of *Quercus petraea*, 25-IX-2001, leg. K.O. Romanenko fc-380 (AH 45922).

Remarks—The SEM examination reveals that one half of the spore is ornamented by a reticulum of 8–12 angular to hexagonal meshes with solid, unperforated walls, while the other hemisphere is smooth or only faintly ornamented (Moreno et al. 2013).

Stemonitis flavogenita E. Jahn, Verh. Bot. Ver. Prov. Brandenb. 45: 165 (1904)

Sporocarps stipitate, sporotheca violaceous-brown, cylindrical, ≤6.5 mm high overall. Stalk blackish, hollow, horny, 2.5 mm tall. Columella spreading throughout the sporotheca and ending in an apical funnel. Capillitium comprising an outer peridial network (with small meshes) and an internal net (with very wide meshes). Spores 6–7.7 μm diam., globose to subglobose, brown violet in transmitted light, slightly spinulose.

Specimens examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Izobilniy forestry, cordon Taryer, 600 m, oak–maple forest, wood of deciduous tree, 28-IX-2000, leg. K.O. Romanenko fc-89 (AH 45923); Bakhchysarai forestry, cordon Zubrovaya

Polyana, 450 m, oak–maple forest, wood of *Carpinus betulus*, 30-IX-2001, leg. K.O. Romanenko fc-419 (AH 45924).

Remarks—The spore ornamentation of *Stemonitis flavogenita* is very similar to *S. splendens* Rostaf., which is distinguished by the absence of a columella funnel and an outer surface net with very large meshes. A photograph of sporocarps and detail of the columella of material from Chihuahua (Mexico) can be found in Salazar-Marquez et al. (2014).

Stemonitis herbatica Peck, Ann. Rep. N.Y. St. Mus. Nat. Hist. 26: 75 (1874)

Sporocarps stipitate, 5–6 mm tall overall. Stalk blackish, hollow, horny, 1.5–2 mm high. Capillitium formed by a surface net and internal branches with wide angular nodes. Spores 7–8 μm diam., globose to subglobose, pale violaceous, ornamented by small warts.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Central forestry, the hill Big Chuchel, 900 m, beech forest, leaf litter of *Fagus sylvatica*, 13-VII-2001, leg. K.O. Romanenko fc-282 (AH 45925).

Symphytocarpus amaurochaetoides Nann.-Bremek., Proc. K. Ned. Akad. Wetensch., Ser. C, 70: 220 (1967) Figs 2m–o

Sporocarps stipitate, violet-blackish, clustered, forming a pseudoaethalium. Stalk conspicuous, black, expanding into a well-developed columella that extends to the sporothecal apex. Capillitium dark, smooth, with no surface net, although sometimes ends of threads join to form small teeth. Spores 6–8 μm diam., globose to subglobose, brown-violaceous, with a faint and incomplete reticulum (similar to spore ornamentation of *Stemonitis fusca* Roth). SEM examination reveals an ornamentation formed by perforated walls, with a few pillars raising the walls above the surface of the spore.

Specimen examined: **UKRAINE**, **Crimea**, **Crimean Nature Reserve**, Bakhchysarai forestry, cordon Zubrovaya Polyana, 450 m, alder–maple forest, dead wood of *Acer campestre*, 19-VII-2001, leg. K.O. Romanenko fc-277 (AH 45926).

Remarks—A rather rare species, known mostly from Europe (http://discoverlife.org).

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